

## REMARKS

### Summary of Office Action

Claims 1-15 were pending in this application.

The specification was objected to for failing to provide proper antecedent basis for the claimed subject matter and lacking support in the specification for claim 14. The specification was objected to for being unclear as to the meaning of the terms "glass metal" and "clarified".

Claims 1 and 13 were objected to because of certain enumerated informalities.

Claim 11 was rejected under 35 U.S.C. § 112, first paragraph, for failing to comply with the written description requirement.

Claims 1, 3, 10, and 12-15 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite.

Claim 1 and 15 were rejected under 35 U.S.C. § 102(b) as being anticipated by Japan 09-77533 (hereinafter "Japan '533").

Claim 1 and 5-7 were rejected under 35 U.S.C. § 103(a) as being obvious from Japan 10-273657 (hereinafter "Japan '657").

Claim 1, 12, and 13 were rejected under 35 U.S.C. § 103(a) as being obvious from Japan '533.

Claim 1, 4, 9, 10, and 15 were rejected under 35 U.S.C. § 103(a) as being obvious from Takai et al. U.S. Patent No. 4,963,441 (hereinafter "Takai") in view of Yocom et al. U.S. Patent No. 6,071,432 (hereinafter "Yocom").

Claim 1-10 and 12-14 were rejected under 35 U.S.C. § 103(a) as being obvious from Odlum U.S. Patent No. 6,197,712 (hereinafter "Odlum") in view of Hase et al. U.S. Patent No. 5,839,718 (hereinafter "Hase"), Yocom, Murazaki et al. U.S. Patent No. 6,617,781 (hereinafter "Murazaki"), Murayama et al. U.S. Patent

No. 5,424,006 (hereinafter "Murayama"), and Kanenari et al. U.S. Patent No. 6,431,236 (hereinafter "Kanerari").

#### Summary of Applicants' Reply

Applicants have amended the specification in order to more particularly describe the invention, and have amended claims 1, 10, 12, and 13 to more particularly define the claimed invention. Applicants have also canceled claims 9, 11, 14, and 15 without prejudice. No new matter has been added and the amendments are fully supported by the originally filed specification (see, e.g., applicants' specification at p. 9, ll. 9-22 and Example 4).

The Examiner's objections and rejections are respectfully traversed.

#### Reply to the Objection To the Specification

The specification was objected to for failing to provide proper antecedent basis for the claimed subject matter and for being unclear as to the meaning of the terms "glass metal" and "clarified." Applicants respectfully traverse these objections.

Applicants have amended the specification to incorporate aluminate glass into the detailed description of the claimed invention. No new matter has been added. Support for this amendment can be found, for example, in originally filed claim 1. Additionally, the term "glass metal" has been corrected to be --glass melt-- in various parts of the disclosure. No new matter has been added. The terms glass metal and glass melt are known to be interchangeable to those skilled in the art as shown on p. 66, chapter 4 of "Glass-making Processes" (1st edition, 6th printing, April, 1993) (hereinafter "Glass") (copy of pages 66, 236-237, and 323-324 are enclosed with

partial translation by applicants' Chinese patent agents).

With regard to the term "clarified," it is a well known term widely used by those skilled in the art. A discussion of the process of glass melting is well known to those skilled in the art. The "melting of glass" is found at chapter 14, pp. 236-299, of Glass. The terms "clarify" and "clarification" are explained on p. 237 of Glass to mean the removal of visible bubbles when heating of the glass metal is continued and the viscosity of the glass metal decreases.

Applicants respectfully submit that the specification, as amended, is no longer objectionable. Accordingly, applicants respectfully request the objections of the specification be withdrawn.

Reply to the Objection  
To Claims 1 and 13

Claims 1 and 13 were objected to because of certain enumerated informalities. Applicants respectfully traverse this rejection.

Applicants note with appreciation the Examiner's suggestion to rewrite claims 1 and 13 using alternative language or Markush format and to remove the description of the process of making the glass. Applicants have rewritten claim 1 in Markush format, and have amended claim 13 to remove the reference to the "glass blower" apparatus.

Applicant respectfully submits that claims 1 and 13, as amended, no longer objectionable. Accordingly, applicants respectfully request the objections be withdrawn.

Reply to the Rejection Under 35 U.S.C § 112  
Of Claims 1, 3, 10, 12, and 13

Claims 1, 3, 10, 12, and 13 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for various enumerated reasons. Applicants respectfully traverse these rejections.

Applicants have amended claim 1 and 10 to remove the reference to the term "conventional". Applicants have also amended claims 12 and 13 to depend from claim 1.

Applicants respectfully submit that claims 1, 3, 10, 12, and 13, as amended, are in compliance with 35 U.S.C. § 112. Accordingly, applicants respectfully request these rejections be withdrawn.

Reply to the Rejection Under  
35 U.S.C § 102(b) Of Claim 1

Claim 1 and 15 were rejected under 35 U.S.C. § 102(b) as being anticipated by Japan '533. Applicants respectfully traverse this rejection.

Applicants' claim 1, as amended, is directed to a light-storage self-luminescent glass, comprising (a) a light-storage self-luminescent material activated by multiple ions and (b) a matrix glass. The light-storage self-luminescent material has a particle size ranging from 0.55 mm to 20 mm (see, e.g., Example 4 of applicants' specification).

Japan '533 describes a light-storage self-luminescent material with a particle size that is no larger than 200 mesh (i.e., 0.075 mm). Japan '533 does not show or suggest applicants' claimed invention of a self-luminescent material having a particle size ranging from 0.55 mm to 20 mm specified by claim 1, as amended.

Applicants respectfully submit that claim 1, as amended, is patentable over Japan '533. Claims 2-8 and

10-13, which depend from independent claim 1, are therefore also patentable.

Reply to the Rejection Under  
35 U.S.C § 103(a) Of Claim 1 and 5-7

Claims 1 and 5-7 were rejected under 35 U.S.C. § 103(a) as being obvious from Japan '657. Applicants respectfully traverse this rejection.

Applicants' claim 1, as amended, is directed to a light-storage self-luminescent glass, comprising (a) a light-storage self-luminescent material activated by multiple ions and (b) a matrix glass. The light-storage self-luminescent material has a particle size ranging from 0.55 mm to 20 mm.

Japan '657 describes light storage accessories having luminescent powder with a particle size of 5-50  $\mu$ m. The Examiner contends that "[p]roduct claims with numerical ranges which overlap prior art ranges were held to have been obvious ..." (Office Action, p. 4, paragraph 5). Japan '657 does not show or suggest applicants' claimed invention of a self-luminescent material having a particle size from 0.55 mm to 20 mm specified by claim 1, as amended.

Additionally, the light-storage self-luminescent glass of applicants' claimed invention has an improved luminance and a longer afterglow time. The particle size of the present invention is an important factor for improving the luminance of the light-storage self-luminescent material.

Applicants respectfully submit that claim 1, as amended, is patentable over Japan '657. Claims 5-7, which depend from independent claim 1, are therefore also patentable.

Reply to the Rejection Under  
35 U.S.C § 103(a) Of Claim 1, 12, and 13

Claim 1, 12, and 13 were rejected under  
35 U.S.C. § 103(a) as being obvious from Japan '533.  
This rejection is respectfully traversed.

As described above, applicants' claim 1, as amended, is directed to a light-storage self-luminescent glass, comprising (a) a light-storage self-luminescent material activated by multiple ions and (b) a matrix glass. The light-storage self-luminescent material has a particle size ranging from 0.55 mm to 20 mm.

Japan '533 describes forming a luminous glass having a high luminance at night by incorporating an aluminate phosphor. The Examiner contends that "[p]roduct claims with numerical ranges which overlap prior art ranges were held to have been obvious ..." (Office Action, p. 5, paragraph 2). As discussed above, Japan '533 does not show or suggest applicants' claimed invention of a self-luminescent material having a particle size ranging from 0.55 mm to 20 mm specified by claim 1, as amended.

Applicants respectfully submit that claim 1, as amended, is patentable over Japan '533. Claims 12 and 13 which depend from independent claim 1, are therefore also patentable.

Reply to the Rejection Under  
35 U.S.C § 103(a) Of Claim 1, 4, and 10

Claim 1, 4, and 10 were rejected under  
35 U.S.C. § 103(a) as being obvious from Takai in view of Yocom. Applicants respectfully traverse this rejection.

Applicants' claim 1, as amended, is directed to a light-storage self-luminescent glass, comprising (a) a light-storage self-luminescent material activated by multiple ions and (b) a matrix glass. The light-storage

self-luminescent material has a particle size ranging from 0.55 mm to 20 mm.

Takai describes a light-storing fluorescent material having the property of storing radiant energy of a visible ray and gradually giving it out in the dark. Takai does not show or suggest applicants' claimed invention of a self-luminescent material having a particle size ranging from 0.55 mm to 20 mm specified by claim 1, as amended.

Yocom describes a method of creating long-lasting red emitting phosphors. Yocom does not show or suggest applicants' claimed invention of a self-luminescent material having a particle size ranging from 0.55 mm to 20 mm specified by claim 1, as amended.

Yocom describes a particle size to be between 20-40 microns and Takai describes a particle size to be between 5-500 microns. Neither Yocom nor Takai shows or suggests applicants' claimed feature of a light-storage self-luminescent glass, comprising from a light-storage self-luminescent material with a particle size ranging from 0.55 mm to 20 mm. Therefore, Yocom and Takai, whether taken alone or in combination (whether or not such a combination is proper) do not show or suggest all the features of applicants' claimed invention.

Applicants respectfully submit that claim 1, as amended, is patentable over Takai in view of Yocom. Claims 4 and 10 which depend from independent claim 1, are therefore also patentable.

Reply to the Rejection Under  
35 U.S.C § 103(a) Of Claim 1-9 and 12-13

Claim 1-9 and 12-13 were rejected under 35 U.S.C. § 103(a) as being obvious from Odlum in view of Hase, Yocom, Murazaki, Murayama, and Kanenari. Applicants respectfully traverse this rejection.

Applicants' claim 1, as amended, is directed to (a) a light-storage self-luminescent glass, comprising a light-storage self-luminescent material activated by multiple ions and (b) a matrix glass. The light-storage self-luminescent material has a particle size ranging from 0.55 mm to 20 mm.

Odlum describes a light storage self-luminescent glass having 2-40wt% light storage self-luminescent material with a particle size of 18-25 microns. Applicants respectfully submit that Odlum does not show or suggest a light-storage self-luminescent material having a particle size ranging from 0.55 mm to 20 mm as specified in applicants' claim 1, as amended.

None of the secondary references makes up the deficiencies of Odlum in this regard. The Examiner relies on Hase, Yocom, Murazaki, Murayama, and Kanenari only for their alleged teachings of self-luminescent materials which are not melted or destroyed in the range of about 954-1093°C. Neither Odlum nor the secondary references, shows or suggests applicants' claimed feature of a light-storage self-luminescent material having a particle size ranging from 0.55 mm to 20 mm. Therefore, Odlum, Hase, Yocom, Murazaki, Murayama, and Kanenari, whether taken alone or in combination (whether or not such a combination is proper) do not show or suggest all the features of applicants' claimed invention.

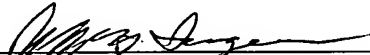
Applicants respectfully submit that claim 1, as amended, is patentable over Odlum in view of Hase, Yocom, Murazaki, Murayama, and Kanenari. Claims 2-9 and 12-13 which depend from independent claim 1, are therefore also patentable.



Conclusion

For the reasons set forth above, applicants respectfully submit that this application, as amended, is in condition for allowance. Reconsideration and allowance of this application are respectfully requested.

Respectfully submitted,



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Annex (total 7 pages)

高等学校轻工专业试用教材

Glass-making Processes

# 玻璃工艺学

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glass metal (or glass melt)

## 第四章 玻璃的粘度

### 4-1 概 述

在重力、机械力和热应力等的作用下，玻璃液(或玻璃熔体)中的结构组元(离子或离子组元)相互间发生流动。如果这种流动是通过结构组元依次占据结构空位的方式进行，则称为粘滞流动。当作用力超过“内摩擦”阻力时，就能发生粘滞流动。

粘滞流动用粘度衡量。粘度是指面积为 $S$ 的两平行液层，以一定的速度梯度 $\frac{dv}{dx}$ 移动时需克服的内摩擦阻力 $f$ 。

$$f = \eta S \frac{dv}{dx}$$

式中 $\eta$ 为粘度，或粘度系数，其单位为帕·秒。

玻璃的粘度随温度下降而增大。从玻璃液到固态玻璃的转变，粘度是连续变化的，其间没有数值上的突变。这一点不同于晶体，后者加热至熔化温度时，粘度是突然改变的。

粘度是玻璃的重要性质之一。它贯穿着玻璃生产的各个阶段，从熔制、澄清、均化、成形、加工、直到退火都与粘度密切相关。在成形和退火方面粘度起着控制性的作用。例如在高速成形机的生产中，粘度必须控制在一定的范围内，而成形机的机速决定于粘度随温度的递变速度。此外玻璃的析晶和一些机械性能也与粘度有关。

影响玻璃粘度的主要因素是化学组成和温度，在转变区范围，还与时间有关。不同玻璃对应于某一定粘度值的温度不同。例如粘度为 $10^{12}$ 帕·秒( $10^{12}$ 泊)时，钠钙硅玻璃的相应温度为560℃左右，钾铅硅玻璃为430℃左右，而钙铝硅玻璃却为720℃左右。在玻璃生产中许多工序(和性能)都可以用粘度作为控制和衡量的标志。

### 粘度和温度的关系

对于同一种玻璃，其粘度随温度的变化规律是同一类型。只是粘度随温度的变化速度以及对应于某给定粘度的温度有所不同。在 $10^{12}$ 帕·秒(或更低)至约 $10^{11}$ 帕·秒的粘度范围内，玻璃的粘度由温度和化学组成决定，而从约 $10^{11}$ 帕·秒至 $10^{10}$ 帕·秒(或更低)的范围内，粘度又是时间的函数。

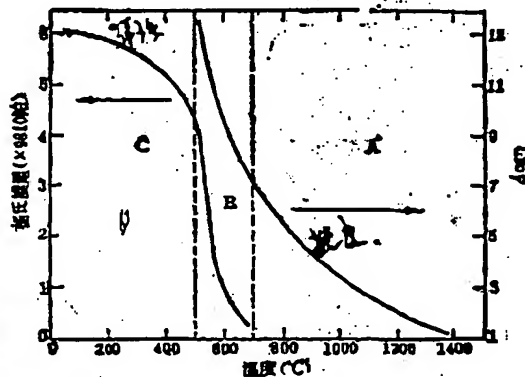


图4-1  $\text{Na}_2\text{O}-\text{CaO}-\text{SiO}_2$  玻璃的弹性，粘度与温度的关系

## 第十六章 玻璃的成形

### 16-1 玻璃的成形

玻璃成形，是熔融的玻璃液转变为具有固定几何形状制品的过程。玻璃必须在一定范围内才能成形。在成形时，玻璃液除作机械运动之外，还同周围介质进行连续热交换。由于冷却和硬化，玻璃首先由粘性液态转变为可塑态，然后再转变成刚性固态。玻璃的成形过程是极其复杂的多种性质不同作用的综合。其中，机械的和热的作用具有重要的意义。

机械作用与玻璃液在一定温度下的流变性质有关，是玻璃液在外力（压力，拉力等）作用下，其内部各部分的移动特点所决定的。玻璃流变性质的最重要的指标是玻璃的表面张力和弹性。温度低时，弹性的影响特别显著。

玻璃液的冷却和硬化，主要取决于在成形中连续地同周围介质进行热传递所产生的热现象。这种热现象受到传热过程的制约，与玻璃液本身及其周围介质的热物理性质，如比热、导热率、透热性、传热系数等有关。

在生产中，玻璃制品的成形过程和其他塑性材料相同，分为成形和定形两个阶段。第一阶段是赋予制品以一定的几何形状。第二阶段是把制品的形状固定下来。玻璃的成形和定形是连续进行的，定形实际上是成形的延续。但是定形所需要的时间比成形所需的时间要长。决定于成形阶段的因素是玻璃的流变性，即粘度、表面张力、可塑性、弹性以及这些性质的温度变化特征。决定于定形阶段的因素是玻璃的热性质和周围介质影响下玻璃的硬化速度。

各种玻璃制品的成形工艺过程，一般是根据实验数据和实际参数，采用实验的方法来确定的。

### 16-2 玻璃的主要成形性质

#### 16-2.1 玻璃的粘度

在成形过程中，玻璃的粘度起着十分重要的作用。玻璃的粘度随温度下降而增大的特性是玻璃制品成形和定形的基础。在高温范围内钠钙硅酸盐玻璃粘度的增加较慢，而在1000~900℃间，粘度增加很快，即粘度的温度梯度 $\left(\frac{\Delta\eta}{\Delta T}\right)$ 突然增大，曲线变弯，如图16-1所示。玻璃的粘度温度梯度大的是短性玻璃，反之为长性玻璃。玻璃的成形温度范围选择在接近粘度—温度曲线的弯曲处，以保证玻璃具有自动定形的某种速度。玻璃的液线温度比成形温度低。如某种钠钙硅酸盐玻璃，其成形温度为1178℃（相当于粘度10<sup>10</sup>帕·秒即10<sup>10</sup>泊）而其液线温度为1038℃（相当于粘度10<sup>12</sup>帕·秒即10<sup>12</sup>泊）。在成形过程

中, 由于粘度的增高, 很快地通过了大结晶倾向区而不析晶。

玻璃制品成形开始和终结时的粘度变化随玻璃的组成、成形方法、制品尺寸大小和重量等是不相同的。成形开始时的粘度大约为 $10^{1.5-4}$ 帕·秒, 如玻璃纤维开始成形的粘度为 $10^{1.5-2}$ 帕·秒, 平板玻璃为 $10^{1.5-3}$ 帕·秒, 玻璃瓶罐为 $10^{1.75-2.25}$ 帕·秒, (小型轻量瓶为 $10^{1.75}$ 帕·秒, 大型重瓶为 $10^{2.25}$ 帕·秒), 拉管及人工成形为 $10^{3-5}$ 帕·秒。成形的终了粘度为 $10^{0-1}$ 帕·秒。但是, 概括来说, 可以认为一般玻璃的形成范围为 $10^2 \sim 10^8$ 帕·秒。

玻璃的粘度愈小, 流变性就愈大。通过温度的控制, 使玻璃的粘度改变, 即可改变玻璃的流变性, 以达到成形和定形。

玻璃的粘度-温度曲线, 只能定性说明玻璃硬化速度的快慢, 也就是只能说明成形制度的快慢。而没有把时间因素考虑在内。为了把玻璃的粘度与成形机器的动作联系起来, 玻璃的硬化速度采用粘度-时间曲线, 即粘

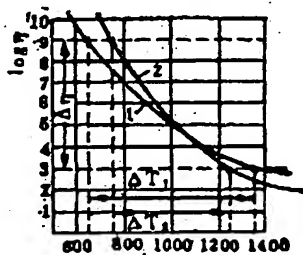


图16-1 玻璃液的粘度与温度关系

1—长性玻璃 2—重性玻璃

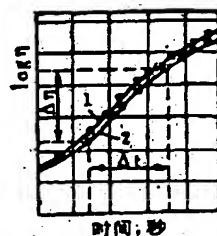


图16-2 玻璃的粘度与冷却时间的关系

1—玻璃制品的表面层 2—中间层

度的时间梯度( $\frac{\Delta \eta}{\Delta t}$ )来定量地表示, 如图16-2所示。

利用玻璃粘度的可逆性, 可以在成形过程中多次加热玻璃, 使之反复达到所需要的成形粘度, 以制造复杂的制品。

在吹制成形中粘度还可以自动调节制品壁的厚薄。任何局部薄壁会立即引起这一区域的粘度提高从而使玻璃变硬, 造成对于吹制的拉伸抗力。厚壁部分温度较高、粘度较小, 易于拉伸, 最终使制品壁的厚薄比较均匀。

玻璃的粘度是玻璃组成的函数, 改变组成就可以改变玻璃的粘度及粘度的温度梯度, 使之适应于成形的温度制度。但是玻璃组成的改变影响到玻璃的其他性质发生变化, 应当十分注意。

### 16-2.2 玻璃的表面张力

在成形过程中表面能力也起着重要的作用。表面张力表示表面的自由能, 使表面有尽量缩小的倾向。玻璃的表面张力也是温度和组成的函数, 随着温度降低表面张力增高, 但变化很小, 大约温度每上升205°C, 表面张力降低2%。玻璃组成对表面张力的影响, 在第一篇中业已叙述。

玻璃的表面张力在高温时作用速度快, 而在低温或高粘度时作用速度缓慢。如粘度为 $10^3$ 帕·秒时, 表面张力的作用速度为几秒钟, 在粘度为 $10^4$ 帕·秒时, 作用速度为几分钟, 在粘度为 $10^8$ 帕·秒时, 作用速度为数小时。所以在较低温度时, 表面张力对成形的影响不大。

表面张力使自由的玻璃液滴成为球形。不用模形吹制料泡和对滴料供料机料滴形状

The melting of glass can be divided into 5 stages: the formation of silicate, the formation of glass, clarification, homogenization and cooling.

## 第十四章 玻璃的熔制

### 14-1 玻璃的熔制过程

将配合料经过高温加热形成均匀的、无气泡的(即把气泡、条纹和结石等减少到容许限度),并符合成型要求的玻璃液的过程,称为玻璃的熔制。玻璃熔制是玻璃生产中很重要的环节。玻璃的许多缺陷(如气泡、结石、条纹等),都是在熔制过程中造成的。玻璃的产量、质量、合格率、生产成本、燃料消耗和池窑寿命等都与玻璃的熔制有密切关系。因此,进行合理的玻璃熔制,是使整个生产过程得以顺利进行,并生产出优质玻璃制品的重要保证。

玻璃的熔制是一个非常复杂的过程,它包括一系列物理的、化学的、物理化学的现象和反应。这些现象和反应的结果,使各种原料的机械混合物变成了复杂的熔融物即玻璃液。

为了尽可能缩短熔制过程和获得优质玻璃,必须充分了解玻璃熔制过程中所发生的变化和进行熔制所需要的条件,从而寻求一些合适的工艺过程和制定合理的熔制制度。

各种配合料在加热形成玻璃过程中,有许多物理的、化学的和物理化学的现象,是基本相同的。它在加热时所发生的变化大致如下:

物理过程: 包括配合料的加热、吸附水分的蒸发排除、某些单独组份的熔融、某些组份的多晶转变、个别组份的挥发( $\text{Na}_2\text{O}$ ,  $\text{K}_2\text{O}$ ,  $\text{B}_2\text{O}_3$ ,  $\text{PbO}$ ,  $\text{SiF}_4$ ,  $\text{BF}_3$ ,  $\text{F}_2$ 等)。

化学过程: 包括固相反应、各种盐类的分解、水化物的分解、化学结合水的排除、组份间的相互反应及硅酸盐的生成。

物理化学过程: 包括低共熔物的生成、组份或生成物间的相互溶解,玻璃和炉气介质之间的相互作用、玻璃液和耐火材料的相互作用及玻璃液和其中夹杂气体的相互作用等。

以上一般性的现象,在每种实际的配合料中进行的次序可能是不同的。发生这些现象的温度也可能是不同的。它们与配合料组成的性质有关。

对于玻璃熔制的过程,由于在高温下的反应很复杂,尚难获得最充分的了解。但大致可分为五个阶段,硅酸盐形成、玻璃形成、澄清、均化和冷却。这五个阶段各有特点,分述如下。

#### (一) 硅酸盐形成

硅酸盐生成反应在很大程度上是在固体状态下进行的。配合料各组份在加热过程中经过一系列的物理变化和化学变化。主要的固相反应结束了,大部分气态产物从配合料中逸出。在这一阶段结束时,配合料变成由硅酸盐和二氧化硅组成的不透明烧结物。制造普通钠钙硅酸盐玻璃时,硅酸盐形成在800~900℃基本结束。

#### (二) 玻璃的形成

烧结物连续加热时即开始熔融。易熔的低共熔混合物首先开始熔化,在熔化的同时



### (三) Clarification

Heating of the glass metal is continued and the viscosity of the glass metal decreases, and gaseous material is emitted from the heated glass metal. That is, clarification is a step at which visible bubbles are removed.

发生硅酸盐和剩余二氧化硅的互溶。到这一阶段结束时，烧熔物变成了透明体，再没有未起反应的配合料颗粒了。但玻璃液中还有大量气泡，而玻璃液本身在化学组成和性质上也不均匀，有很多条纹。熔制普通玻璃时，玻璃的形成在1200~1250℃完成。

#### (三) 澄清

玻璃液继续加热，其粘度降低，并从中放出气态混杂物，即进行去除可见气泡的过程。熔制普通玻璃时，澄清在1400~1500℃结束。这时玻璃液粘度 $\eta \approx 10$ 帕·秒。

#### (四) 均化

玻璃液长时间处于高温下，其化学组成逐渐趋向均一，即由于扩散的作用，使玻璃中条纹，结石消除到允许限度，变成均一体。玻璃液是否均一，可由测定不同部位玻璃的折射率或密度的一致程度来鉴定。熔制普通玻璃时，均化可在低于澄清的温度下完成。

#### (五) 冷却过程

经澄清均化后将玻璃液的温度降低200~300℃，以便使玻璃液具有成形所必需的粘度。在冷却过程中，应不损坏玻璃的质量。

玻璃熔制的各个阶段，各有其特点，同时它们又是彼此互相密切联系和相互影响的。在实际熔制中，常常是同时进行或交错进行的。这主要决定于熔制的工艺制度和玻璃熔窑结构的特点。它们之间的关系可以用图14-1表示。

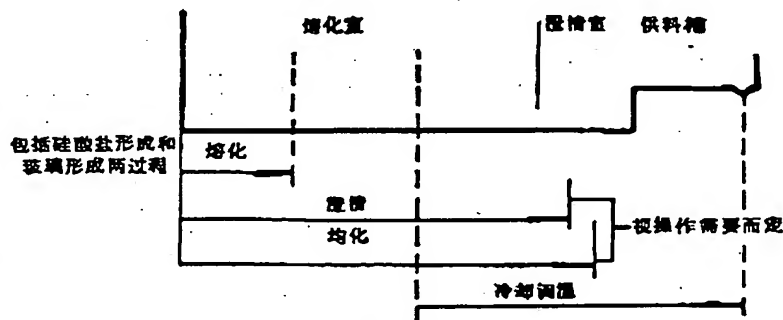


图14-1 玻璃熔制过程各阶段间关系图

在玻璃熔制的过程中存在着固相、液相和气相。以上诸相相互作用，由此而构成极为复杂的相的转化和平衡关系。

熔制玻璃的目的是在高温下使多种固相的配合料转变为单一的、均匀的玻璃液相。是一个从固相向液相转化，并与气相相互作用下消除可见气泡的过程，为此必须研究诸相的相互作用、发展趋向和平衡关系。

## 14-2 硅酸盐形成和玻璃形成

为了研究硅酸盐形成和玻璃形成，必须了解配合料的各组份在加热至完全熔化过程中所引起的各种反应变化。如单组份、二组份及多组份在加热过程中的变化。

在实际生产中，钠钙硅酸盐玻璃系统产量较大，占一半以上。本章阐述的内容主要是关于这类玻璃组成的反应过程。



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